

Intraseasonal Teleconnection between North American and Western North Pacific Monsoons with 20-day Period

Xianan Jiang

Atmospheric and Oceanic Sciences Program, Princeton University, Princeton, NJ

Ngar-Cheung Lau

NOAA/Geophysical Fluid Dynamics Laboratory, Princeton University, Princeton, NJ

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Corresponding author address: Dr. Xianan Jiang, Jet Propulsion Laboratory, MS 183-501, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109. E-mail: xianan@caltech.edu.

Abstract

Based on a recently released, high-resolution reanalysis dataset for the North American region, the intraseasonal variability (ISV, with periods of about 20 d) of the North American Monsoon (NAM) is examined. The rainfall signals associated with this phenomenon first emerge near the Gulf of Mexico and eastern Pacific at about 20°N. They subsequently migrate to the southwestern U.S. along the slope of the Sierra Madre Occidental. The rainfall quickly dissipates upon arrival at the desert region of Arizona and New Mexico (AZNM). The enhanced rainfall over AZNM is accompanied by strong southeasterly low-level flow along the Gulf of California. This pattern bears strong resemblance to the circulation related to “gulf surge” events, as documented by many studies. The southeasterly flow is associated with an anomalous low vortex over the subtropical eastern Pacific Ocean off California, and a mid-latitude anticyclone over the central U.S in the lower troposphere. This flow pattern is in broad agreement with that favoring the “wet surges” over the southwestern U.S.

It is further demonstrated that the aforementioned low-level circulations associated with ISV of the NAM are part of a prominent trans-Pacific wave-train extending from the western North Pacific (WNP) to the Eastern Pacific/North America along a “great circle” path. The circulation anomalies along the axis of this wave-train exhibit a barotropic vertical structure over most regions outside of the WNP, and a baroclinic structure over the WNP, thus suggesting the important role of convective activities over the WNP in sustaining this wave-train. This inference is further substantiated by an analysis of the pattern of wave activity-flux vectors. Variations in the WNP convection are correlated with the ISV of the monsoons in both North American and East Asian (EA)/WNP sectors. These relationships lead to notable teleconnections between NAM and the EA/WNP monsoon on 20-day time scales.